NASA Langley Research Center
Center Innovation Fund

Airborne Wind Energy

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Among a number of small businesses, the race is on to find the best solution to harness airborne wind energy. The current state of the art of the technology is larger, horizontal axis wind turbines, some as large as six or seven mega watts. However, the return on investment or cost of energy is not yet competitive.

NASA expertise may be able to help.

Dave North, an engineer at NASA Langley Research Center, has been working with a diverse team, including high school and college students, to apply their collective engineering knowledge and skills to developing a airborne wind energy prototype. North's goal is to raise the Technology Readiness Level to a point where it can easily be handed off to commercial companies.

"NASA Langley, in particular, has skills and expertise in areas, like aerodynamics and control and materials, where we can do research and bring them up to a readiness level and then be able to push this out to the private sector."

Potentially, NASA could also use an airborne wind energy concept for planetary exploration. Because sunlight intensity on the surface of Mars is very low, the rovers get very little power for their solar panels.

"If you look at the wind conditions on Mars, they're quite strong on average so we're trying to look at airborne wind platforms that would be used for Mars exploration for energy on the surface of Mars."

After a previous systems study, North and other team members have prototyped a two-kilowatt demonstrator kite with two-lines that flies in a figure-eight pattern.

NASA Langley wind energy prototype with power production flight pattern highlighted

"In the next configuration, we are looking at single line configurations where we have on-board flight control where we can use one tether line and then flaps or rudders on the vehicle to steer the kite."

Ground station for NASA Langley wind energy prototype

By using line speed and tension, North's team has been taking measurements.

"Our controllers can basically work like a regenerative motor in a Toyota Prius vehicle where it converts the mechanical energy in the shaft to electrical power. We currently have a resistor bank in our demonstrator where we can dump that electrical power."

For the next demonstrator, the team plans to scale up to a large kilowatt range and convert to actual electrical power.